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# Comparisons of depression, anxiety, well-being, and perceptions of the built environment amongst adults seeking social, intermediate and market-rent accommodation in the former London Olympic Athletes' Village

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## ABSTRACT

The Examining Neighbourhood Activities in Built Living Environments in London (ENABLE London) study provides a unique opportunity to examine differences in mental health and well-being amongst adults seeking social, intermediate (affordable rent), and market-rent housing in a purpose built neighbourhood (East Village, the former London 2012 Olympic Athletes' Village), specifically designed to encourage positive health behaviours. Multi-level logistic regression models examined baseline differences in levels of depression, anxiety and well-being across the housing groups. Compared with the intermediate group, those seeking social housing were more likely to be depressed, anxious and had poorer well-being after adjustment for demographic and health status variables. Further adjustments for neighbourhood perceptions suggest that compared with the intermediate group, perceived neighbourhood characteristics may be an important determinant of depression amongst those seeking social housing, and lower levels of happiness the previous day amongst those seeking market-rent housing. These findings add to the extensive literature on inequalities in health, and provide a strong basis for future longitudinal work that will examine change in depression, anxiety and well-being after moving into East Village, where those seeking social housing potentially have the most to gain.

## 1. Introduction

Depression, anxiety and low levels of positive well-being are associated with an increased risk of coronary heart disease (CHD), illness and total mortality (Cohen and Pressman, 2006; Chida and Steptoe, 2008; Gale et al., 2014). Depression is thought to be one of the principal causes of total years lost due to disability worldwide (Marcus et al., 2012; WHO, 2015) and is predicted to be the second leading cause of global disease by 2020 (Murray and Lopez, 1996; WHO, 2004). Previous studies have suggested that positive well-being including increased levels of happiness, pleasure, purpose in life and life satisfaction, protect against both physical and mental illness (WHO, 2004; Dolan et al., 2006; Raphael et al., 2005).

People with lower socio-economic status (SES) generally experience higher rates of morbidity and mortality (Goldman, 2001). Low SES is also associated with poorer mental health outcomes and emotional distress, which in turn increase the risk of physical illness and mortality (Hunt et al., 1985; Griffin et al., 2002). People with low SES generally live in lower quality neighbourhoods that are characterised by lower perceived safety, access to fewer shops and leisure facilities, and higher levels of crime (Ferrer-i-Carbonell and Gowdy, 2007; Lelkes, 2006).

There is a growing recognition of the importance of the local built environment to health. Increasing evidence from both cross-sectional and longitudinal studies suggest that both structural and social attributes can affect the mental health of its residents (Roux and Mair, 2010; Kling et al., 2007; Willson et al., 2007; Astell-Burt et al.,

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2015). Negative perceptions of the neighbourhood (e.g. perceived level of accessibility to greenspace, more crime, feeling unsafe, less walkability) have been found to be associated with depression, anxiety (Ellaway et al., 2009; Lorenc et al., 2012; James et al., 2017), and both physiological and self-reported measures of stress (Abraham et al., 2010). Positive perceptions are associated with higher rates of physical activity which, in turn, may reduce depression and cardiovascular risk with potential benefits for both physical and mental health (Shanahan et al., 2016). However, effects of the built environment on mental health and well-being may be moderated by socio-economic status (James et al., 2017).

Emerging evidence suggests that housing tenure is an important determinant of health (Szabo et al., 2017). Studies from the UK have shown that housing tenure (owner occupied, rented from the public sector or rented privately) is associated with illness and mortality (Filakti and Fox, 1995; Fogelman et al., 1987). Compared with those who rent, owning your own home appears to be associated with fewer chronic illnesses (Smith et al., 2001; Hiscock et al., 2003; Macintyre et al., 2001), and lower mortality rates (Filakti and Fox, 1995; Fogelman et al., 1987; McMunn et al., 2009). Furthermore, those who rent are more likely to experience mental health problems and symptoms of depression and anxiety (Macintyre et al., 2001; Ellaway and Macintyre, 1998; Kind et al., 1998). Owning your own home not only provides physical security but also a sense of control, status, and autonomy (Szabo et al., 2017; Sixsmith and Sixsmith, 2008; Wiles et al., 2012). Amongst certain groups such as the elderly, economically inactive, or unemployed, housing tenure might provide a better indication of socio-economic advantage when compared with measures such as occupation or income (Smith and Egger, 1992). Moreover, housing tenure has been shown to have an effect on health not only because of its association with income, but also because of its association with housing stressors (Ellaway and Macintyre, 1998). Poorer housing conditions (including dampness and mould), which are not uncommon in Local Authority rented homes (Scottish Homes, 1993), are also associated with chronic illness, psychological distress (Hunt, 1990; Platt et al., 1989; Hyndman, 1990; Packer et al., 1994), and poor mental health (Packer et al., 1994; Gabe and Williams, 1987). Housing quality and perceived safety of the local environment may also exert an influence on mental (Birchneil et al., 1988; Sooman and Macintyre, 1995; Hunt and McKenna, 1992) and physical health outcomes (Ellaway and Macintyre, 1998). Despite these observations, the direct effect of housing tenure on health related outcomes, including well-being and psychological outcomes such as depression (Szabo et al., 2017), remains under researched and a novel area of inquiry. In particular, there is limited evidence from longitudinal studies or studies that examine the effects of change in environment on markers of health and well-being. One such study used data from the Moving To Opportunities (MTO) housing mobility experiment which found substantial improvements in subjective well-being amongst adults who had moved from economically distressed neighbourhoods (high poverty) to less distressed neighbourhoods 10–15 years after the move (Ludwig et al., 2013).

Mental health problems are common amongst those with lower SES (Goldman, 2001), and those with low SES are less likely to be able to afford to move into a neighbourhood that has lower crime rates and where one feels safe (Lovasi et al., 2016). The Examining Neighbourhood Activities in Built Living Environments in London (ENABLE London) study, is a natural experiment evaluating the extent to which health behaviours change amongst adults with differing socio-economic backgrounds, who are seeking to move into social, intermediate (affordable rent / shared ownership), and market-rent (private rent) housing in East Village (formerly, the London 2012 Olympic Athletes' Village), which was specifically designed to encourage positive health behaviours. Using data from the ENABLE London study at baseline, this paper aimed to: (i) assess cross-sectional differences in depression, anxiety and well-being among participants who were

seeking a move into three different housing sectors in East Village; and (ii) examine the extent to which any difference can be explained by demographic factors or by perceptions of the neighbourhood in which they currently live.

## 2. Methods

### 2.1. Study design

The ENABLE London study takes advantage of a unique opportunity based on the major and focused change of a brownfield site to an inner city urban built environment designed to encourage walking, cycling, and healthy living (East Village London E20, 2016; London Legacy Development Corporation, 2012). The former London 2012 Olympics Athletes Village, renamed East Village is a high quality, high density, mixed-use residential development, with housing units provided for residents from social housing (largely on the social housing register), intermediate housing (a mix of affordable rent, shared ownership and shared equity), and for market-rent (private rent). The study design and procedures have been detailed elsewhere (Ram et al., 2016). Ethical approval was obtained from the National Research Ethics Committee London: City Road and Hampstead (REC Reference 12/LO/1031).

### 2.2. Participant recruitment

The ENABLE London study recruited participants from those seeking accommodation in East Village consisting of three distinct housing sector groups; those seeking social accommodation were largely on the social housing register, i.e. housed by the local council, and were in need of rehousing, those seeking affordable market-rent (intermediate) accommodation, and accommodation for market-rent who were largely residing in private rental housing. Three separate phases of recruitment for the three housing sectors took place between January 2013 and December 2015. This was governed by the staged release of different housing tenure status available for occupation. Individuals on the social housing register (largely from the London Borough of Newham) were among the first to be invited to take part in the study by the housing association responsible for allocating East Village social housing (East Thames Group). Priority for East Village social housing accommodation was based on a points system which included, current living conditions (e.g. household composition vs. number of bedrooms), maximum earning threshold, employment status, credit history, tenancy management and health circumstances. Participants from the social housing group were invited to take part in the study during their interview for eligibility by East Thames Group between January 2013 and May 2014. Individuals seeking intermediate accommodation in East Village were approached by the ENABLE London study researchers and representatives of the intermediate housing association (Triathlon Homes) in a marketing suite, and invited to take part in the study between July 2013 and November 2014. Prospective tenants were required to be living or working in London, be a first time buyer, have an annual household income less than £66,000 for 1 and 2 bedroom homes, or below £80,000 for 3 bedroom homes. Those seeking market-rent accommodation in East Village, owned by Get Living London, were approached directly by ENABLE London study researchers in a marketing suite and recruited between September 2014 and December 2015.

### 2.3. Data collection and outcomes

Participants were contacted by phone to arrange a suitable date and time for assessments. Other household members were also invited to take part. All participants were assessed at baseline in their original place of residence, before any move to East Village. Participants were given a self-completion questionnaire on a laptop with trained re-

searchers present to assist where necessary.

## 2.4. Mental health and well-being indicators

### 2.4.1. Depression and anxiety

Depression and anxiety were measured using the Hospital Anxiety and Depression Scale (HADS) (Zigmond and Snaith, 1983). The HADS includes two subscales to assess anxiety and depression, each with seven items scored between zero and three. The maximum score for each subscale is 21. Scores of eight or more on each subscale indicated 'caseness', i.e., meeting the threshold for being anxious or depressed (Zigmond and Snaith, 1983; Bjelland et al., 2002). These definitions of 'caseness' were used to create a binary outcome; 'case' and 'non-case'.

### 2.5. Well-being

Items used in the National Well-being Measurement Programme to assess well-being, included satisfaction with life ('Overall, how satisfied are you with your life nowadays?'), feelings that things one does are worthwhile ('Overall, to what extent do you feel that the things you do in life are worthwhile?'), and feelings of happiness the previous day ('Overall, how happy did you feel yesterday?') (ONS, 2015). Each item was rated on a 10-point scale, ranging from 'not at all' (1) to 'extremely' (10). Scores were dichotomised into, 'very low/low' (scores of 1–6), and 'medium/high' (scores 7–10) (ONS, 2012a).

### 2.6. Perceptions of the local neighbourhood

Exploratory Factor Analysis (EFA) was carried out on the statements assessing perceptions of the local neighbourhood, which were taken from several validated questionnaires. Some items were reworded for ease of understanding (Supplementary Table 1). Responses were re-coded from +2 (positive perceptions) to -2 (negative perceptions). Factor loadings were rotated using varimax (orthogonal) rotation. Two scales were produced including a total of 11 statements from a possible 14 (three items did not load strongly onto either of the two factors retained after orthogonal rotation): (i) perceptions of neighbourhood crime (i.e. vandalism, feeling unsafe to walk in neighbourhood, presence of threatening groups) (Cronbach's alpha = 0.87); and (ii) perceptions of neighbourhood quality (i.e. accessible features, attractiveness, enjoyment of living in neighbourhood) (Cronbach's alpha = 0.78). Scores were derived for each scale by summing responses; positive scores indicated lower perceptions of crime and nicer neighbourhoods.

### 2.7. Demographic factors

All demographic data (sex, age, ethnicity, marital status, level of education), and the health status variable of a limiting longstanding illness which is an important determinant of well-being (Manor et al., 2001; Wilkinson and Marmot, 2003) were self-reported at baseline. Age was categorised into four groups: 16–24 years; 25–34 years; 35–49 years; and 50+ years. Based on the Census (ONS, 2011), ethnicity was categorised into five groups, 'White', 'Asian', 'Black', 'Mixed', and 'Other'. Few participants reported being of 'Mixed' or 'Other' ethnicity so these two groups were combined, and a total of four ethnic groups were used for analysis. Marital status was categorised into three groups: 'married/cohabiting'; 'not living with partner'; and 'unknown'. Education level was divided into three groups based on the Census (ONS, 2011): 'Degree or equivalent/Higher'; 'Intermediate qualification' (including apprenticeship, A Levels, GCSEs); and 'Other/None' (including foreign or work related qualification). The National Statistics Social-Economic Coding (NS-SEC) was used to categorise employed participants into 'higher managerial or professional' occupations, 'intermediate occupations', 'routine or manual' occupations using responses to questions relating to work status, job title and description

of work (ONS, 2010). Two further categories were included using the International Labour Organisation (ILO) definitions of 'unemployed' including those who were seeking work or on a Government work scheme, and 'economically inactive' including those who were retired, looking after home and family, students, and those unable to work due to ill health (ILO, 1982). Responses to questions relating to long term illness or disability limiting day-to-day activities (ONS, 2011) were dichotomised as 'yes' (including 'Yes, limited a lot' and 'Yes, limited a little') or 'no'.

### 2.8. Statistical analysis

All statistical analyses were carried out using STATA/SE software (Stata/SE 13 for Windows; StataCorp LP, College Station, TX, USA). For participants who had a single item missing on the HADS subscales, scores were imputed using the mean score of the valid responses (GL Assessment, 2015). Those with two or more missing responses on any of the subscales were excluded from analysis. All primary outcomes (depression, anxiety and well-being), demographic factors and health status were analysed as categorical. Descriptive analysis for the three housing sectors were carried out on all covariates and primary outcome measures. Univariate differences were assessed using chi-squared ( $\chi^2$ ) tests. Multi-level logistic regression models, fitting household as a random effect, to take account of the natural clustering of adults per household, were used to examine the associations between housing sector and binary outcomes of depression, anxiety and well-being (Model A). Progressive adjustment for covariates included: age, sex and ethnicity (Model B); marital status (Model C); and educational level (Model D), with a further adjustment for health status (limiting longstanding illness, Model E). For each model, the odds ratios for housing sector were examined to assess the effect of adjusting for additional covariates. The neighbourhood perception scales were then added to the model (as a continuous variable) to examine their effect on each outcome; Model F1 was Model E with additional adjustment for perceptions of neighbourhood crime; Model F2 was Model E with additional adjustment for perceptions of neighbourhood quality; and Model F3 was Model E adjusted for perceptions of neighbourhood crime and quality. The largest housing sector (intermediate) was chosen *a priori* as the reference group. For all regression models, the odds ratio (OR) and corresponding 95% confidence interval (CI) are reported.

## 3. Results

### 3.1. Recruitment and response rates

A total of 1819 households agreed to be contacted to receive further information about the study, and 1006 households agreed to participate (55% of households who provided their details). Including more than one adult per household provided a total of 1278 adult participants; 520 adults seeking social housing, 524 adults seeking intermediate housing, and 234 adults seeking market-rent housing (Ram et al., 2016). For multi-level logistic regression analyses, 1213 (95%) participants had complete data on all variables of interest. There were no differences in any outcomes between participants included in the analyses and those who were omitted due to missing data ( $n = 65$ ) (data not presented).

### 3.2. Baseline characteristics

Baseline characteristics of all adult participants seeking social, intermediate and market-rent accommodation in East Village are summarised in Table 1. Participants seeking social housing were older (46% aged 35–49 years), mainly female (73%), and of black (48%) or Asian (21%) ethnic origin compared with those seeking intermediate and market-rent accommodation (all  $p < 0.001$ ). The social housing

**Table 1**  
Baseline characteristics for 1278 adult participants from 1006 households by housing sector.

	Social	Intermediate	Market-rent	Total	p-value ( $\chi^2$ )
<b>Household response rate</b>	392 (52%)	421 (57%)	193 (58%)	1006	
<b>Adult individuals</b>	520	524	234	1278	
<b>Household composition (%)</b>					
1 person	28 (5%)	38 (7%)	31 (13%)	97 (8%)	< 0.001
2 people	88 (17%)	217 (41%)	80 (34%)	385 (30%)	
3 people	101 (19%)	116 (22%)	61 (26%)	278 (22%)	
4 or more people	303 (58%)	153 (29%)	62 (27%)	518 (41%)	
<b>Children in household (%)</b>					
Yes	425 (82%)	93 (18%)	24 (10%)	542 (42%)	< 0.001
<b>Marital status (%)</b>					
Married/cohabiting	202 (39%)	261 (50%)	93 (40%)	556 (44%)	< 0.001
Not living with partner	244 (47%)	245 (47%)	126 (54%)	615 (48%)	
Unknown	74 (14%)	18 (3%)	15 (6%)	107 (8%)	
<b>Age group (in years) (%)</b>					
16–24	107 (21%)	97 (19%)	71 (30%)	275 (22%)	< 0.001
25–34	132 (25%)	302 (57%)	114 (49%)	548 (43%)	
35–49	237 (46%)	107 (21%)	24 (10%)	368 (29%)	
50+	44 (8%)	18 (3%)	25 (11%)	87 (7%)	
<b>Sex (%)</b>					
Female	379 (73%)	249 (48%)	103 (44%)	731 (57%)	< 0.001
<b>Ethnicity (%)</b>					
White	96 (18%)	358 (68%)	163 (70%)	617 (48%)	< 0.001
Asian	108 (21%)	77 (15%)	29 (12%)	214 (17%)	
Black	251 (48%)	55 (11%)	17 (7%)	323 (25%)	
Mixed/ Other	65 (13%)	34 (6%)	25 (11%)	124 (10%)	
<b>Qualifications<sup>a</sup> (%)</b>					
Degree or equivalent / Higher	122 (24%)	428 (82%)	186 (80%)	736 (58%)	< 0.001
Intermediate qualification	280 (54%)	70 (13%)	30 (13%)	380 (30%)	
Other / None	117 (23%)	25 (5%)	17 (7%)	159 (12%)	
<b>Occupational Status<sup>b</sup> (%)</b>					
NSSEC. <sup>c</sup> Higher Managerial / Professional	61 (12%)	375 (72%)	155 (66%)	591 (46%)	< 0.001
Intermediate Occupations	62 (12%)	79 (15%)	38 (16%)	179 (14%)	
Routine / Manual	125 (24%)	34 (6%)	11 (5%)	170 (13%)	
ILO <sup>d</sup> Unemployed	73 (14%)	7 (1%)	11 (5%)	91 (7%)	
Economically inactive	192 (37%)	25 (5%)	19 (8%)	236 (18%)	
<b>Limiting longstanding illness (%)</b>					
Yes	107 (21%)	41 (8%)	14 (6%)	162 (13%)	< 0.001
<b>Anxiety and Depression<sup>e</sup> (%)</b>					
Anxiety case	177 (35%)	151 (29%)	83 (36%)	411 (33%)	0.07
Depression case	168 (35%)	97 (19%)	33 (15%)	298 (24%)	< 0.001
<b>Satisfaction with life<sup>f</sup> (%)</b>					
Very low/Low	169 (33%)	117 (22%)	44 (19%)	330 (26%)	< 0.001
Medium/High	349 (67%)	406 (78%)	189 (81%)	944 (74%)	
<b>Worthwhile<sup>g</sup> (%)</b>					
Very low/Low	123 (24%)	95 (18%)	47 (20%)	265 (21%)	0.08
Medium/High	394 (76%)	428 (82%)	186 (80%)	1008 (79%)	
<b>Happiness<sup>h</sup> (%)</b>					
Very low/Low	157 (30%)	130 (25%)	71 (30%)	358 (28%)	0.10
Medium/High	361 (70%)	393 (75%)	162 (70%)	916 (72%)	
<b>Neighbourhood perceptions mean (SD)</b>					
Neighbourhood crime	0.69 (4.59)	2.94 (3.96)	2.95 (4.18)	2.03 (4.40)	< 0.001
Neighbourhood quality	2.41 (4.58)	4.36 (4.41)	4.13 (4.20)	3.52 (4.53)	< 0.001

$\chi^2$  Chi-square test.

<sup>a</sup> 3 missing responses.

<sup>b</sup> 8 participants economically active unclassified; 3 missing responses.

<sup>c</sup> NSSEC employment categories (ONS, 2010).

<sup>d</sup> ILO definitions: unemployed includes 'seeking work' or on a 'Government work scheme'; economically inactive includes looking after home/family, retired, students, and unable to work due to ill health (ILO, 1982).

<sup>e</sup> 18 missing responses (anxiety); 57 missing responses (depression). Scores calculated on 8/21 cut-off point.

<sup>f</sup> 4 missing responses.

<sup>g</sup> 5 missing responses.

<sup>h</sup> 4 missing responses.

group were more likely to be from larger households (4 or more people), of which 60% included one or two children, whilst those seeking intermediate and market-rent accommodation were mostly in one or two-person adult households (48% and 47% respectively). Participants seeking intermediate accommodation were most likely to be married or cohabiting (50%) compared with the other groups. Fewer participants in the social housing group reported having a degree or equivalent / higher (24%), and just over half were either unemployed (14%) or economically inactive (37%). There was a marked association

between housing type being sought and limiting longstanding illness, which affected 21% of those seeking social housing, 8% of the intermediate group, and 6% of the market-rent group ( $p < 0.001$ ). Participants seeking intermediate and market-rent housing had similar mean scores for perceptions of neighbourhood crime and neighbourhood quality; mean scores were lower for the social housing group for both neighbourhood perception scales (Table 1). Overall, participants seeking social housing perceived their neighbourhoods as having more crime and as being of poorer quality when compared with the other



**Table 2**

Odds ratios examining associations between housing sector and well-being outcomes, with the intermediate sector as the reference group.

	Model A		Model B		Model C		Model D		Model E	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
<b>Depression case</b>										
Intermediate	1.00		1.00		1.00		1.00		1.00	
Social	2.46 (1.72, 3.52)	< 0.001	2.35 (1.54, 3.58)	< 0.001	2.43 (1.57, 3.76)	< 0.001	1.89 (1.18, 3.04)	0.01	1.84 (1.12, 3.03)	0.02
Market-rent	0.68 (0.43, 1.10)	0.12	0.76 (0.47, 1.22)	0.26	0.74 (0.46, 1.21)	0.23	0.75 (0.46, 1.22)	0.24	0.77 (0.47, 1.28)	0.32
<b>Anxiety case</b>										
Intermediate	1.00		1.00		1.00		1.00		1.00	
Social	1.32 (0.95, 1.83)	0.10	1.51 (1.02, 2.23)	0.04	1.52 (1.02, 2.25)	0.04	1.47 (0.94, 2.30)	0.09	1.40 (0.89, 2.19)	0.14
Market-rent	1.46 (0.97, 2.20)	0.07	1.41 (0.94, 2.11)	0.10	1.38 (0.92, 2.07)	0.12	1.39 (0.93, 2.09)	0.11	1.44 (0.96, 2.17)	0.08
<b>Less satisfied with life</b>										
Intermediate	1.00		1.00		1.00		1.00		1.00	
Social	1.66 (1.20, 2.30)	< 0.001	1.43 (0.97, 2.11)	0.07	1.41 (0.95, 2.07)	0.09	1.31 (0.85, 2.03)	0.23	1.25 (0.81, 1.94)	0.32
Market-rent	0.80 (0.53, 1.23)	0.32	0.82 (0.53, 1.26)	0.36	0.78 (0.50, 1.20)	0.26	0.78 (0.50, 1.20)	0.26	0.80 (0.52, 1.24)	0.32
Intermediate	1.00		1.00		1.00		1.00		1.00	
Social	1.33 (0.97, 1.81)	0.08	1.34 (0.92, 1.96)	0.12	1.35 (0.92, 1.98)	0.13	1.19 (0.77, 1.84)	0.43	1.14 (0.74, 1.77)	0.55
Market-rent	1.15 (0.78, 1.71)	0.48	1.14 (0.76, 1.70)	0.54	1.09 (0.73, 1.64)	0.67	1.10 (0.73, 1.64)	0.66	1.12 (0.75, 1.68)	0.58
<b>Low levels of feeling happy yesterday</b>										
Intermediate	1.00		1.00		1.00		1.00		1.00	
Social	1.33 (0.96, 1.84)	0.09	1.42 (0.97, 2.08)	0.08	1.39 (0.94, 2.05)	0.10	1.33 (0.86, 2.07)	0.20	1.30 (0.84, 2.01)	0.24
Market-rent	1.48 (0.99, 2.20)	0.053	1.51 (1.01, 2.24)	0.04	1.46 (0.98, 2.18)	0.06	1.48 (0.99, 2.21)	0.054	1.50 (1.01, 2.24)	0.045

Model A: includes random effect for household; Model B: Model A + age, sex, ethnicity; Model C: Model B + marital status; Model D: Model C + qualification level; Model E: Model D + limiting illness.

OR= odds ratio; CI = confidence interval.

housing sectors. Across all participants, around a quarter (24%) were classified as depressed, 33% were classified as anxious, and 26% reported low levels of satisfaction with life. Marked differences were observed by housing group with over a third (35%) of the social housing group classified as depressed, compared with 19% of participants seeking intermediate and 15% of participants seeking market-rent housing ( $p < 0.001$ ). Anxiety prevalence did not differ markedly across the housing sectors. There was a socio-economic gradient in the proportion of individuals reporting low levels of life satisfaction; 33% of the social group, 22% of the intermediate group, and 19% of the market-rent group were less satisfied with life ( $p < 0.001$ ). Low levels of 'feeling things one does in life are worthwhile' and 'feeling happy the previous day' were relatively uncommon and reported similarly across housing groups.

### 3.3. Associations between housing sector and depression, anxiety and well-being

Results for multi-level regression analyses examining associations between measures of depression, anxiety and well-being and housing sector are presented in Table 2.

### 3.4. Depression and anxiety

Regression analyses showed higher levels of depression amongst participants seeking social housing compared with participants in the intermediate group (OR 2.46; 95% CI = 1.72–3.52) (Table 2, Model A). Adjustments for age, sex, and ethnicity (Model B), attenuated the OR (2.35; 95% CI = 1.54–3.58) suggesting some confounding effects, although adjustment for marital status (Model C) appeared to strengthen the OR, it was attenuated after further adjustment for educational status (OR 1.89; 95% CI = 1.18–3.04). After adjustment for all demographic and health status variables (Model E), participants seeking social housing were more likely to be depressed compared with those in the intermediate group (OR 1.84, 95% CI: 1.12, 3.03). In contrast, participants seeking market-rent housing showed no appreciable differences in levels of depression compared with those in the intermediate group.

The social housing group were also more likely to be categorised as 'anxious' compared with those seeking intermediate housing (OR 1.32;

95% CI = 0.92–1.83). The OR was strengthened after adjustments for age, sex and ethnicity (OR 1.51; 95% CI = 1.02–2.23) and marital status (OR 1.52; 95% CI = 1.02–2.25). However, adjustments for educational level (Model D) and illness (Model E) attenuated the ORs. Anxiety amongst those seeking market-rent housing did not differ markedly compared with intermediate group and generally the OR remained stable after adjustment for all demographic variables.

### 3.5. Well-being

Low levels of satisfaction with life were also associated with housing sector; those in the social housing group had lower levels of life satisfaction compared with participants seeking intermediate housing (OR 1.66; 95% CI = 1.20–2.30). After progressive adjustment for demographic factors, the ORs became weaker, suggesting confounding effects of age, sex, ethnicity, marital status, educational level, and illness. There were no differences between participants seeking market-rent housing and participants in the intermediate group in levels of life satisfaction, and progressive adjustments for demographic factors did not affect the OR appreciably.

Both the social housing and market-rent groups were more likely to report low feelings of 'things you do in life are worthwhile' compared with participants seeking intermediate housing. Adjusting for age, sex, ethnicity, and additionally adjusting for marital status did not appreciably affect the OR for participants seeking social housing compared with the intermediate group. However, further adjustments for educational level and illness attenuated the ORs towards the null (OR 1.14; 95% CI = 0.74–1.77). Progressive adjustment for demographic factors in Model B to E had little impact on the OR for low feelings of things you do in life are worthwhile amongst those seeking market-rent accommodation compared with the intermediate group.

Participants seeking social housing were more likely to report low levels of happiness the previous day compared with the intermediate group (OR 1.33; 95% CI = 0.96–1.84). The OR was strengthened by adjustments for age, sex and ethnicity, but further adjustments in Model C to E attenuated the ORs. Conversely the OR, for feeling happy yesterday amongst participants seeking market-rent accommodation compared with the intermediate group remained stable after progressive adjustments for all demographic factors in Model E (OR 1.50; 95% CI = 1.01–2.24).

### 3.6. Adjusting for perceptions of local neighbourhood

Associations between perceptions of the neighbourhood (crime and quality), and depression, anxiety and well-being were examined. There was a consistent inverse association between neighbourhood perceptions of both crime and quality and all well-being measures for all housing groups combined (Supplementary Table 2). Associations between neighbourhood perceptions and well-being outcomes were consistent across the three housing groups (data not presented). As the results showed strong associations between perceptions of the neighbourhood and well-being outcomes, we examined the impact of adjustment for neighbourhood perception scores on housing group differences in depression, anxiety and well-being including further adjustments to Model E in Table 2 (all demographic factors). After full adjustment for demographic factors in Model E, participants seeking social housing were more likely to be depressed, anxious, less satisfied with life, have low feelings of 'things you do in life are worthwhile', and low feelings of happiness yesterday when compared with the intermediate group. For all the primary outcomes, ORs were weakened by adjustment for neighbourhood perceptions of crime (Model F1), quality (Model F2), and more so by adjustment for both crime and quality neighbourhood factors (Model F3) (Table 3). This suggests that neighbourhood perceptions partially explain differences in depression, anxiety and lower well-being between those seeking social and intermediate housing. In contrast, the ORs comparing levels of depression, anxiety, life satisfaction, and feeling things you do in life are worthwhile between those seeking market-rent and intermediate accommodation were relatively unaffected by adjustment for neighbourhood perceptions of crime and quality. However, low levels of happiness the previous day remained of borderline significance after adjusting for neighbourhood perceptions of crime, neighbourhood perceptions of quality, and for both crime and quality. To ensure results from the main analyses were consistent within specific population subgroups, we examined the direction of associations of all primary outcomes by: (i) sex; (ii) narrower age groups 16–24 years, 25–34 years, and 35–49 years; and (iii) white and non-white ethnicity. Results did not differ appreciably between these different subgroups (data not presented).

## 4. Discussion

The main aims of this paper were to describe baseline differences in depression, anxiety and well-being in participants seeking three different housing sectors included in the ENABLE London study, and to examine the extent to which any of the differences could be explained by demographic factors, and individuals' perceptions of their neighbourhoods. There were marked demographic differences between the housing sectors. Participants seeking social housing had greater representation of females, and black and Asian participants. Fewer participants in this group had a degree qualification, half were either unemployed or economically inactive, and most were living in households of four or more people which included one or two children. In comparison, participants seeking intermediate and market-rent accommodation were predominantly white European, had similar levels of education and occupational social status, and were mainly from adult-only households with a composition of two people.

Further analyses showed that those seeking social housing were more likely to be depressed, anxious and less satisfied with life compared with the other two housing groups. Participants seeking market-rent accommodation only differed from the intermediate group in having a lower prevalence of feeling happy the previous day. These differences by housing group appear to be at least partly and possibly wholly explained by demographic factors. A number of demographic characteristics including sex, age, ethnic group, marital status and occupational status, have consistently been recognised as important factors in the prevalence of psychological distress and well-being (Akhtar-Danesh and Landeen, 2007; Dolan et al., 2008). The participants seeking social housing in our study were mainly female; several studies have shown differences in levels of stress between men and women (Roe et al., 2013). Women tend to report higher levels of happiness (Alesina et al., 2004), but also experience more feelings of depression and anxiety than men (Kessler, 2003; Rosenfield et al., 2005). Those seeking social housing were also largely of black or Asian ethnic origin; these groups report poorer health (Becares, 2013; Nazroo, 2003), and higher levels of anxiety and low levels of well-being when compared with white ethnic groups (Hicks, 2013). Furthermore, being married or in a partnership is positively associated with higher levels of life satisfaction (Helliwell, 2003; Blanchflower and Oswald, 2008) and lower levels of depression and anxiety

**Table 3**

Odds ratios examining associations between housing sector and well-being outcomes with additional adjustment for neighbourhood perceptions of crime and quality, with the intermediate sector as the reference group.

	Model E		Model F1		Model F2		Model F3	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
<b>Depression case</b>								
Intermediate	1.00		1.00		1.00		1.00	
Social	1.84 (1.12, 3.03)	0.02	1.64 (1.00, 2.70)	0.05	1.52 (0.92, 2.50)	0.10	1.49 (0.90, 2.46)	0.12
Market-rent	0.77 (0.47, 1.28)	0.32	0.78 (0.47, 1.28)	0.33	0.77 (0.46, 1.29)	0.33	0.77 (0.46, 1.29)	0.33
<b>Anxiety case</b>								
Intermediate	1.00		1.00		1.00		1.00	
Social	1.40 (0.89, 2.19)	0.14	1.22 (0.78, 1.91)	0.38	1.25 (0.80, 1.96)	0.33	1.18 (0.75, 1.85)	0.48
Market-rent	1.44 (0.96, 2.17)	0.08	1.43 (0.96, 2.14)	0.08	1.43 (0.95, 2.14)	0.08	1.43 (0.95, 2.14)	0.08
<b>Less satisfied with life</b>								
Intermediate	1.00		1.00		1.00		1.00	
Social	1.25 (0.81, 1.94)	0.32	1.12 (0.72, 1.76)	0.61	1.02 (0.65, 1.60)	0.94	1.00 (0.64, 1.58)	0.99
Market-rent	0.80 (0.52, 1.24)	0.32	0.80 (0.51, 1.24)	0.32	0.79 (0.51, 1.24)	0.31	0.79 (0.51, 1.24)	0.31
Intermediate	1.00		1.00		1.00		1.00	
Social	1.14 (0.74, 1.77)	0.55	1.05 (0.68, 1.64)	0.82	0.96 (0.61, 1.50)	0.86	0.95 (0.61, 1.49)	0.84
Market-rent	1.12 (0.75, 1.68)	0.58	1.12 (0.74, 1.68)	0.59	1.11 (0.74, 1.68)	0.61	1.11 (0.74, 1.68)	0.61
Intermediate	1.00		1.00		1.00		1.00	
Social	1.30 (0.84, 2.01)	0.24	1.17 (0.75, 1.84)	0.49	1.07 (0.69, 1.67)	0.76	1.06 (0.68, 1.65)	0.81
Market-rent	1.50 (1.01, 2.24)	0.045	1.50 (1.00, 2.25)	0.05	1.50 (1.01, 2.22)	0.05	1.50 (1.00, 2.23)	0.05

Model E includes adjustments for random effect for household, age, sex, ethnicity, marital status, qualifications and limiting illness; Model F1: includes Model E + neighbourhood perceptions of crime; Model F2 includes Model E + neighbourhood perceptions of quality; Model F3 includes Model E + neighbourhood perceptions of crime and quality. OR= odds ratio; CI = confidence interval.

(Blanchflower and Oswald, 2008); fewer participants in the social housing group in our study reported being married or cohabiting. Previous work has also indicated a U-shaped relationship between age and measures of well-being; depression is higher, while satisfaction and happiness are lower in mid-life (ONS, 2016a). Those seeking social housing included a high proportion of participants aged between 35 and 50 years, but there was no clear pattern of association between age and the outcomes assessed here. However it must be noted that the spread of age was limited.

Health inequalities across the groups seeking different housing types were apparent. We found that those who were seeking social housing were of lower SES (less likely to have a degree or higher degree qualification, and more likely to be unemployed or economically inactive). This group were also more likely to be categorised as depressed and anxious, and have lower levels of positive well-being. These findings are consistent with other studies showing that those in social housing are more socio-economically disadvantaged, and are at greater potential risk of poorer mental health outcomes, due to increased stress exposures associated with their surroundings (Ellaway and Macintyre, 1998; Birchnell et al., 1988; Sooman and Macintyre, 1995; Hunt and McKenna, 1992). Associations between well-being and neighbourhood characteristics such as perceived levels of crime, safety, access to greenspace, have shown negative effects on depression, anxiety and well-being (James et al., 2017; Marmot and Bell, 2012; Stafford and Marmot, 2003; Cummins et al., 2005). Prolonged exposure to poor quality neighbourhoods has an adverse impact on well-being (Leslie and Cerin, 2008). Our results show that positive perceptions of neighbourhood crime and quality appeared to reduce differences in depression, anxiety and well-being between the participants seeking social and intermediate housing suggesting that the negative neighbourhood perceptions observed amongst those seeking social housing may contribute to the higher levels of depression within this group. Conversely, neighbourhood perceptions did not appear to affect differences in depression, anxiety and well-being between those seeking market-rent and intermediate housing. The only exception was difference in low levels of happiness the previous day, which appeared to be partially explained by neighbourhood perceptions. The importance of the built environment on depression, anxiety and well-being have been reported previously (Lorenc et al., 2012; Cummins et al., 2005; Giles-Corti et al., 2016). Plausibly, mental health outcomes of those affected by poorer surroundings might be improved by moving people into environments that encourage positive well-being (Ludwig et al., 2013). However, this remains to be assessed and will be the subject of longitudinal investigations of the ENABLE London study cohort.

#### 4.1. Strengths and limitations

The participants from widely differing socio-economic backgrounds forming the cohort is a major strength of the current study. This allows us to examine the social gradient of inequalities in mental health across these aspiring housing tenured groups. In particular, the study provides a good representation of participants from a 'hard-to-reach' group (social housing group), who are often underrepresented in population based studies. Overall, 52% of those seeking social housing took part in the study (participation was at 57% for those seeking intermediate, and 58% for those seeking market-rent accommodation). The ethnic composition of those seeking social housing in our study (who were largely from the Newham Social Housing register) was comparable to the ethnic composition of the London Borough of Newham as a whole; 48% black and 21% Asian in ENABLE London vs. 30% and 17% respectively in Newham as a whole (Census, 2011). The questions used to assess positive well-being in the current study are based on those included in the National Well-being Measurement Programme, which have previously been validated for use in large population based studies (ONS, 2015; Dolan et al., 2011; Waldron,

2010). As measured by the National Well-being Measurement Programme, between the years ending September 2013 and September 2015, the UK population had an average mean score of life satisfaction ranging from 7.3 to 7.4, 'feeling things you do in life are worthwhile' ranged from 7.5 and 7.6, and feeling happy yesterday ranged from 7.7 and 7.8 (ONS, 2016b). The mean scores for personal well-being of participants in the ENABLE London study (recruited between 2013 and 2015), showed patterns fairly consistent with those of the UK population: the average mean score for life satisfaction was 7.7; 'feeling things you do in life are worthwhile' was 7.8 and feeling happy yesterday was 7.5. Furthermore, the study measured both positive and negative emotions which are important when assessing overall well-being (Fredrickson, 1998; Pressman and Cohen, 2005). Limitations also warrant consideration. Previous studies have identified several other demographic factors that are commonly linked with mental health outcomes that were not addressed in this paper. For example, household composition, children less than 18 years living in the household and work status (Dolan et al., 2006; Francis et al., 2012). In our early analytical investigations, household composition, children in household, and occupational status were strongly linked with our independent variable (housing sector). The initial aim of the study was to recruit similar numbers of both adults and children (aged 8 years and over), especially as most of the housing in East Village is family-sized (i.e., 2 or more bedrooms). Although recruitment of children was partially achieved amongst those seeking social housing ( $n = 209$ , largely due to the number of families in need of rehousing), the overall demography of those seeking to move to East Village was young adult professionals, especially amongst those seeking intermediate and market-rent accommodation. This demographic profile was an unforeseen outcome of the study, resulting in an adult focus. Further, eligibility criteria for housing in East Village were based on several factors which included having children, employment status, and income. These factors were therefore excluded from regression analysis due to the possibility of over adjustment for covariates that are defining features of each housing sector being sought. Participants included in each housing sector was based upon the type of accommodation being sought, not present housing. However, due to the criteria required to be eligible for social, intermediate and market-rent accommodation in East Village, (i.e., employment status, earning threshold), participants comprising each housing sector at baseline was strongly related with type of accommodation being sought: a total of 67% of participants from the social housing sector were largely residing in accommodation provided by the council or housing association; and those seeking intermediate and market-rent accommodation were mostly living in private rent property (both 64%).

The HADS, a clinical measure of depression and anxiety, was designed for use in medical practices (Zigmond and Snaith, 1983). However, several studies have shown the HADS scale to be a useful tool in assessing depression and anxiety in community settings and within the general population (Ellaway and Macintyre, 1998; Bjelland et al., 2002; Snaith, 2003). Responses from the HADS measure showed appreciable differences in borderline and abnormal outcomes of depression and anxiety between the housing sectors. It is also important to note that perceptions of the neighbourhood may be influenced by psychological distress and poorer well-being, e.g. individuals who are depressed may be more likely to have negative perceptions of their neighbourhood (Ellaway and Macintyre, 1998).

The ENABLE London study was designed and powered to test for differences in physical activity outcomes and thus may lack statistical power to examine cross-sectional differences of well-being across the different housing being sought. However, the relatively large sample size ( $n = 1213$ ) was able to provide potentially important findings of whether depression, anxiety and well-being can be attributed to the local environment.



## 4.2. Future work

Findings from the present study suggest that demographic factors and perceptions of the local neighbourhood appear to account for the differences in depression, anxiety and well-being between those seeking different housing types. The rapid conversion of the London Olympic Village to create East Village in what was previously a brownfield site, provides a unique opportunity for future work to evaluate a ‘natural experiment’, to examine whether moving to a new improved neighbourhood, specifically designed to encourage healthy active behaviour is associated with improved well-being. Two-year follow-up of the cohort will allow us to examine change in levels of depression, anxiety and well-being, and to compare half of the cohort who move to East Village with the remainder who do not move (Ram et al., 2016). If change in well-being outcomes are observed, we will be able to examine whether this can be attributed to particular features of the neighbourhood, which will provide high quality evidence that has been lacking to date (Cummins et al., 2005).

## 5. Conclusions

The findings reported in this paper suggest that the differences in well-being outcomes amongst people seeking social, intermediate and market-rent accommodation in East Village are substantially reduced by adjustment for neighbourhood perceptions, implying that these may be important causes of higher depression, anxiety and lower well-being, particularly amongst participants seeking social housing. The ongoing longitudinal study will provide a powerful test of whether moving into social, intermediate or market-rent accommodation in East Village reduces these differences. Identifying features of the built environment that affect well-being, may help to reduce socio-economic inequalities as a direct result of relocating to a new environment designed to encourage positive health behaviours, where those seeking social housing appear to have the most to gain. In terms of generalisability, the different housing types all shared a common interest in moving into the new neighbourhood, and will be exposed to the same neighbourhood features once they move. This offers a novel opportunity to understand whether the local built environment is experienced and perceived differently by the different housing groups, and how this influences mental health and well-being. While we accept that future housing developments are not likely to be on the same scale as East Village, there is increasing demand for this type of high-density housing, and smaller scale developments continue to be built in London and in other major conurbations elsewhere. The aspiration for new housing is not uncommon, particularly in high density cities, and we believe findings from this study will be of increasing relevance given the acute need for more housing.

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## Contributions

All authors conceptualised and designed the study, coordinated and supervised data collection, interpreted data, critically reviewed and revised the manuscript and approved the final manuscript as submitted. All authors agree to be accountable for all aspects of the work. BR carried out the initial analyses and drafted the initial manuscript.

## Competing interests

None declared.

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## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.healthplace.2017.09.001.

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